

CURRICULUM VITAE

NAME: **Dennis A. Steindler**

PLACE OF BIRTH: Milwaukee, Wisconsin

EDUCATION:

High School:	John Marshall High School, Milwaukee, WI		
Undergraduate:	University of Wisconsin, Madison	B.A.	1973
	Zoology		
Graduate School:	University of Wisconsin, Madison		1973-1975
	Neuroanatomy		
	University of California, San Francisco		
	Anat./Neurobiology	Ph.D.	1977
Postdoctoral:	Max-Planck-Inst. Biophysical Chem., Gottingen, Germany		1978
	Neurophysiology		

UNIVERSITY APPOINTMENTS:

Graduate Student - University of California, San Francisco - Thesis Advisor: Henry J. Ralston, III, M.D.

Assistant Professor - Michigan State University, Department of Anatomy, East Lansing, MI. 1978-1983

Assistant Professor - The University of Tennessee, Memphis, The Health Science Center, Department of Anatomy, Memphis, TN. 1983-84

Associate Professor - The University of Tennessee, Memphis, The Health Science Center, Department of Anatomy and Neurobiology; Center for Neuroscience - 1985-1991

Professor - The University of Tennessee, Memphis, The Health Science Center, Department of Anatomy and Neurobiology; Center for Neuroscience – 1991-2001

Joseph J. Bagnor/Shands Professor of Medical Research, Professor in the Departments of Neuroscience and Neurological Surgery, The McKnight Brain Institute, Program in Stem Cell Biology and Regenerative Medicine, and Shands Cancer Center of the College of Medicine, University of Florida – 2001 - present

Executive Director, The McKnight Brain Institute of the University of Florida, December 2004-present

AWARDS:

- 1973 B.A. with Honors and Distinction in Zoology, University of Wisconsin, Madison
- 1976 Dean's Award for Graduate Research, University of California, San Francisco
- 1977 Fellowship from the Max-Planck Society
- 1984 L.C. Noel Foundation Grant, The University of Tennessee, Memphis, The Health Science Center
- 1993 Golden Apple Award, First Year Medical Students Award for Neuroanatomy Teaching
- 1995 University of Tennessee National Alumni Association Outstanding Teaching Award
- 1995 Sponsor and Graduate Student Advisor for L.B. Thomas, M.D., Selected as the Resident Research Award Winner, American Academy of Neurological Surgeons
- 1996 Golden Apple Award, First Year Medical Students Award for Neuroanatomy Teaching
- 1996 Awarded Fellowship from the Japan Society for the Promotion of Science
- 1997 Awarded Daimler-Benz Foundation Fellowship, Sponsor for Dr. Bjorn Scheffler
- 1998 Patent Technology Award, American Museum of Science and Energy
- 1999 Teaching Award for Medical School Neuroscience
- 1999 Member, Southeast United States Alzheimer's Disease Council
- 2000 Teaching Award for Medical School Neuroscience
- 2001 Outstanding Lecturer Award for Medical School Neuroscience
- 2003 Birch Lecturer, International Neuropsychology Society
- 2003 Nominated, Bristol-Myers Squibb Award for Neuroscience

SERVE AS REVIEWER/ADVISOR FOR:

The Journal of Neuroscience (Associate Editor)
 Experimental Neurology (Editorial Board Member)
 Glia (Editorial Board Member)
 The Journal of Neurocytology (Associate Editor)
 Gene Expression (Editorial Board Member)
 Developmental Brain Research (Editorial Board Member)
 Nature
 Nature Biotechnology
 Nature Medicine

The Lancet
 Trends in Neurosciences
 Science
 The Journal of Comparative Neurology
 The Journal of Neuroscience Methods
 The Journal of Neuroscience Research
 Cerebral Cortex
 Developmental Biology
 Cancer Research
 The Journal of Histochemistry and Cytochemistry
 Proceedings of the National Academy of Sciences (U.S.A.)
 European Journal of Neuroscience
 The National Science Foundation, BBS RTG Panel
 The Swiss National Science Foundation
 Neurology A Study Section, NIH/NINDS, 1985-1988
 Spinal Cord Injury Foundation, Paralyzed Veterans Association
 Veterans Association, Merit Grant Program
 Human Frontiers in Science Grant Program
 Israel National Science Foundation
 National Science Foundation, Develop. Neuroscience Panel, 1991-1994
 Neurology B2 Study Section, NIH/NINDS, 1993
 National Institutes of Aging, Minority Student Fellowship Program, 1995
 Neurological Sciences 2 Study Section, June, 1996
 Special Emphasis Panel, NIH/NINDS, 1999
 NIEHS, Special Emphasis Panel, Parkinson's Disease, 2000
 NIDA, Special Emphasis Panel, Gene Microarray Technology, 2000
 Special Emphasis Review Panel, NIH/NINDS, 2001
 Department of Genetics Review, St. Jude Children's Research Hospital
 The Michael J. Fox Foundation for Parkinson's Research
 Advised Gov. Jeb Bush, Florida Legislature on issues of stem cells/cloning
 Advised the European Union Commission and Parliament on Human Embryonic Stem Cells and Cloning
 NIH, BDCN-2 Grant Review Study Section, 6/01-present; Chairperson 10/02-present
 Scientific Advisory Board Member, Michael J. Fox Foundation for Parkinson's Research, 01/05-

PAPERS:

1. Steindler, D.A. and S.A. Colwell. Reeler mutant mouse: Maintenance of appropriate and reciprocal connections in the cerebral cortex and thalamus. *Brain Research* 113:386-393, 1976.
2. Welt, C. and D.A. Steindler. Somatosensory cortical barrels and thalamic barreloids in reeler mutant mice. *Neuroscience* 2:755-766, 1977.
3. Steindler, D.A. Trigemino-cerebellar projections in normal and reeler mutant mice. *Neuroscience Letters* 6:293-300, 1977.
4. Steindler, D.A. and J.M. Deniau. Anatomical evidence for collateral branching of substantia nigra neurons: A combined horseradish peroxidase and (3H)-wheat germ agglutinin axonal transport study in the rat. *Brain Research* 196:228-236, 1980.

5. Steindler, D.A. Locus coeruleus neurons have axons that branch to the forebrain and cerebellum. *Brain Research* 223:367-373, 1981.
6. Steindler, D.A. Differences in the labeling of axons of passage by wheat germ agglutinin after uptake by cut peripheral nerve versus injections within the central nervous system. *Brain Research* 250:159-167, 1982.
7. Imai, H., D.A. Steindler, and S.T. Kitai. A rapid and simple method for determination of delivery after iontophoretic and pressure injections of radioactive tracer substances. *Journal of Neuroscience Methods* 7:389-396, 1983.
8. Steindler, D.A., L.G. Issacson, and B.K. Trosko. Combined immunocytochemistry and autoradiographic retrograde axonal tracing for identification of transmitters of projection neurons. *Journal of Neuroscience Methods* 9:217-228, 1983.
9. Steindler, D.A. and R.H. Bradley. N-[acetyl-3H] wheat germ agglutinin: anatomical and biochemical studies of a sensitive bidirectionally transported axonal tracer. *Neuroscience* 10: 219-241, 1983.
10. Steindler, D.A. Trigemino-cerebellar, trigemino-tectal, and trigemino-thalamic projections: A double retrograde axonal tracing study in the mouse. *Journal of Comparative Neurology* 237:155-175, 1985.
11. Cusick, C.G., D.A. Steindler, and J.H. Kass. Corticocortical and collateral thalamocortical projections of postcentral somatosensory cortical areas in Squirrel monkeys: A double labeling study with radiolabeled wheat germ agglutinin and wheat germ agglutinin conjugated to horseradish peroxidase. *Somatosensory Research* 3:1-31, 1985.
12. Imai, H., D.A. Steindler and S. T. Kitai. The organization of divergent axonal projections from the midbrain raphe nuclei in the rat. *Journal of Comparative Neurology* 243:363-380, 1986.
13. Cooper, N.G.F. and D.A. Steindler. Lectins demarcate the barrel subfield in the somatosensory cortex of the early postnatal mouse. *Journal of Comparative Neurology* 249:157-168, 1986.
14. Steindler, D.A. and N.G.F. Cooper. Wheat germ agglutinin binding sites in the adult mouse cerebellum: Light and electron microscopic studies. *Journal of Comparative Neurology* 249:170-185, 1986.
15. Cooper, N.G.F. and D. A. Steindler. Monoclonal antibody to glial fibrillary acidic protein reveals a parcellation of individual barrels in the early postnatal mouse somatosensory cortex. *Brain Research* 380:341-348, 1986.
16. Imai, H., M.R. Park, D.A. Steindler and S. T. Kitai. The morphology and divergent axonal organization of midbrain raphe projection neurons in the rat. *Brain and Development* 8:343-354, 1986.
17. O'Brien, T.F. D.A. Steindler and N.G.F. Cooper. Abnormal glial and glycoconjugate dispositions in the somatosensory cortical barrel field of the early postnatal reeler mutant mouse. *Developmental Brain Research* 32:309-317, 1987.

18. Steindler, D.A. and N.G.F. Cooper. Glial and glycoconjugate boundaries during postnatal development of the central nervous system. *Developmental Brain Research* 36:27-38, 1987.
19. Steindler, D.A., O'Brien, T.F. and Cooper, N.G.F. Glycoconjugate boundaries during early postnatal development of the neostriatal mosaic. *Journal of Comparative Neurology* 267:357-369, 1988.
20. Steindler, D.A., N.G.F. Cooper, A. Faissner and M. Schachner. Boundaries defined by adhesion molecules during development of the cerebral cortex: The J1/tenascin glycoprotein in the mouse somatosensory cortical barrel field. *Developmental Biology* 131:243-260, 1989.
21. Steindler, D.A. and B.K. Trosko. Two types of locus coeruleus neurons born on different embryonic days in the mouse. *Anatomy and Embryology* 179:423-434, 1989.
22. Cooper, N.G.F. and D.A. Steindler. Critical period-dependent alterations of the transient body image in the rodent cerebral cortex. *Brain Research* 489:167-176, 1989.
23. Steindler, D.A., A. Faissner, and M. Schachner. Brain "cordones": transient boundaries of glia and adhesion molecules that define developing functional units. *Comments on Developmental Neurobiology* Vol. 1, No. 1, pp. 29-60, 1989.
24. Snow, D.M., D.A. Steindler, and J. Silver. Molecular and cellular characterization of the glial roof plate of the spinal cord and optic tectum: A possible role for a proteoglycan in the development of an axon barrier. *Developmental Biology* 138:359-376, 1990.
25. Steindler, D.A., T.F. O'Brien, E. Laywell, K. Harrington, A. Faissner, and M. Schachner. Boundaries during normal and abnormal brain development: In vivo and in vitro studies of glia and glycoconjugates. *Experimental Neurology* 109:35-56, 1990.
26. Laywell, E.D. and D.A. Steindler. Boundaries and wounds, glia and glycoconjugates: Cellular and molecular analyses of developmental partitions and adult brain lesions. *Annals N. Y. Academy of Science* 633:122-141, 1991.
27. O'Brien, T.F., A. Faissner, M. Schachner, and D.A. Steindler. Afferent-boundary interactions in the developing neostriatal mosaic. *Developmental Brain Research* 65:259-267, 1992.
28. Laywell, E.D., U. Bartsch, U. Dorries, S. Bartsch, A. Faissner, M. Schachner, and D.A. Steindler. Enhanced expression of the developmentally regulated extracellular matrix molecule tenascin following adult brain injury. *Proceedings of the National Academy of Sciences USA*. 89:2634-2638, 1992.
29. Steindler, D.A. Glial boundaries in the developing nervous system. *Annual Review of Neuroscience* 16:445-470, 1993.
30. Brodkey, J.A., M.A. Gates, E.D. Laywell, and D.A. Steindler. The complex nature of interactive neuroregeneration-related molecules. *Experimental Neurology* 123:251-270, 1993.

31. Gates, M.A., T.F. O'Brien, A. Faissner, and D.A. Steindler. Neuron-glial interactions during the in vivo and in vitro development of the nigrostriatal circuit. *Journal of Chemical Neuroanatomy* 6:179-189, 1993.
32. Steindler, D.A., A. Faissner, and K. Harrington. A unique mosaic in the visual cortex of the reeler mutant mouse. *Cerebral Cortex* 4:129-137, 1994.
33. Sajin, B. and D.A. Steindler. Cells on the edge: Boundary astrocytes and neurons, *Perspectives on Developmental Neurobiology*, 2:275-289, 1994.
34. Brodkey, J.A., E.D. Laywell, T.F. O'Brien, A. Faissner, K. Stefansson, U. Dorries, M. Schachner, and D.A. Steindler. Focal brain injury and the upregulation of a developmentally-regulated extracellular matrix protein. *Journal of Neurosurgery* 82:106-112, 1995.
35. Steindler, D.A., D. Settles, H. P. Erickson, E.D. Laywell, A. Yoshiki, A. Faissner, M. Kusakabe. Tenascin knockout mice: Barrels, boundary molecules, and glial scars. *Journal of Neuroscience* 15:1971-1983, 1995.
36. Faissner, A. and D.A. Steindler. Boundaries and inhibitory molecules in developing neural tissues. *Glia* 4:233-254, 1995.
37. Thomas, L.B. and D.A. Steindler. Glial boundaries and scars: Programs for normal development and wound healing in the brain. *The Neuroscientist* 1:142-154, 1995.
38. Thomas, L.B., D. Gates, T.F. O'Brien, J. Schweitzer, E. Richfield, and D.A. Steindler. DNA end labeling (TUNEL) in Huntington's disease and other neuropathological conditions. *Experimental Neurology* 133:265-272, 1995.
39. Gates, M.A., B. Thomas, E. Howard, E.D. Laywell, B. Sajin, A. Faissner, J. Silver and D.A. Steindler. A cell and molecular analysis of the developing and adult mouse subependymal zone of the cerebral hemispheres, *Journal of Comparative Neurology* 361:249-266, 1995.
40. Thomas, L.B., M.A. Gates, and D.A. Steindler. Young neurons from the adult mouse subependymal zone migrate and proliferate along an astrocyte, extracellular matrix-rich pathway, *GLIA* 17:1-14, 1996.
41. Laywell, E.D., P. Friedman, K. Harrington, J.T. Robertson and D.A. Steindler. Cell attachment to frozen sections of injured adult mouse brain: Effects of antibody and lectin perturbation of wound-related extracellular matrix molecules, *Journal of Neuroscience Methods* 66:99-108, 1996.
42. Gates, M.A., E.D. Laywell, H. Fillmore, and D.A. Steindler. Astrocytes and extracellular matrix in adult mice following intracerebral transplantation of embryonic ventral mesencephalon or lateral ganglionic eminence, *Neuroscience* 74:579-597, 1996.
43. Jhaveri, S., R. Erzurumlu, E.D. Laywell, D.A. Steindler, K.M. Albers, and B.M. Davis. Excess nerve growth factor in the periphery does not obscure development of whisker-related patterns in the rodent brain, *Journal of Comparative Neurology* 374:41-51, 1996.

44. Gates, MA. H. Fillmore, and D.A. Steindler. Chondroitin sulfate proteoglycan and tenascin in the wounded adult mouse neostriatum in vitro: Dopamine neuron attachment and process outgrowth, *Journal of Neuroscience* 16:8005-8018, 1996.
45. Settles, D.L., M. Kusakabe, D.A. Steindler, H. Fillmore, and H.P. Erickson. Tenascin-C knockout mouse has no detectable tenascin-C protein, *Journal of Neuroscience Research* 47:109-117, 1997.
46. Goldowitz, D., R. Cushing, E. Laywell, G. Darcangelo, M. Sheldon, H. Sweet, M. Davisson, D. Steindler, and T. Curran. Cerebellar disorganization characteristic of reeler in scrambler mutant mice despite presence of Reelin, *Journal of Neuroscience* 17:8767-8777, 1997.
47. Kukekov, V., E.D. Laywell, L.B. Thomas, and D.A. Steindler. A unique nestin-negative precursor cell from the adult mouse brain gives rise to neurons and glia, *GLIA* 21:399-407, 1997.
48. Kukekov, V., E.D. Laywell, L.B. Thomas, B. Scheffler, K. Davies, T.F. O'Brien, M. Kusakabe, and D.A. Steindler. Multipotent stem/progenitor cells with similar properties arise from two neurogenic regions of adult human brain, *Experimental Neurology* 156:333-344, 1999.
49. Laywell, E.D., V.G. Kukekov, and D.A. Steindler. Multipotent neurospheres can be derived from forebrain subependymal zone and spinal cord of adult mice after protracted post-mortem intervals, *Experimental Neurology* 156:430-433, 1999.
50. Scheffler, B., M. Horn, I. Bluemcke, E.D. Laywell, D. Coomes, V.G. Kukekov, and D.A. Steindler. Marrow-mindedness: a perspective on neurogenesis, *Trends in Neurosciences* 22:348-357, 1999.
51. Suslov, O.N., V.G. Kukekov, E.D. Laywell, B. Scheffler, and D.A. Steindler. RT - PCR Amplification of mRNA from single brain neurospheres, *Journal of Neuroscience Methods* 96:57-61, 2000.
52. Kusakabe, M., L. Mangiarini, E.D. Laywell, G.P. Bates, and D.A. Steindler. Loss of cortical and thalamic neuronal tenascin-C expression in a transgenic mouse expressing exon 1 of the human Huntington disease gene, *Journal of Comparative Neurology* 430:485-500, 2001.
53. Laywell, E.D., P. Rakic, V.G. Kukekov, E. Holland, and D.A. Steindler. Identification of a multipotent astrocytic stem cell in the immature and adult mouse brain. *Proc. Natl. Acad. Sci. USA* 97:13883-13888, 2000.
54. Ignatova, T., V.G. Kukekov, E.D. Laywell, O.N. Suslov, F. Vrionis, and D.A. Steindler. Human cortical glial tumors contain stem-like cells expressing astroglial and neuronal markers in vitro. *GLIA* 39:193-206, 2002.
55. Suslov, O., V.G. Kukekov, T. Ignatova, and D.A. Steindler. Neural stem cell heterogeneity demonstrated by molecular phenotyping of clonal neurospheres in vitro, *Proc. Natl. Acad. Sci. USA* 99:1456-14511, 2002.

56. Zheng, T., D.A. Steindler and E.D. Laywell. Transplantation of an indigenous neural stem cell population leading to hyperplasia and atypical integration, *Cloning and Stem Cells* 4:3-8, 2002.
66. Steindler, D.A. and D. Pincus. Stem cells and neurogenesis in the adult human brain, *The Lancet* 359:1047-1054, 2002.
67. Steindler, D.A. Neural stem cells, scaffolds, and chaperones. *Nature Biotechnology* 20:1091-1093, 2002.
59. Laywell, E.D., Kukekov, V.G., Zheng, T., Suslov, O.N., and D.A. Steindler. Isolation and analysis of neurosphere forming cells from acutely dissociated and postmortem CNS specimens. *Methods in Molecular Biology* 198:15-27, 2002.
60. Kearns, S., Laywell, E.D., Kukekov, V.G. and D.A. Steindler. Extracellular matrix effects on neurosphere cell motility, *Exp. Neurol.* 182:240-244, 2003.
61. Angelestro, J.M., Ignatova, T., Kukekov, V.G., Stengren, G., Steindler, D.A., Mendelsohn, C, and L.A. Green. Regulated expression of ATF5 is required for the progression of progenitor cells to neurons. *J. Neuroscience* 23:4590-4600, 2003.
62. Deng, J., Laywell, E.D., Steindler, D.A., and Petersen, B.E. Neural trans-differentiation potential of hepatic oval cells in the neonatal mouse brain, *Exp. Neurol.* 182:373-382, 2003.
63. Steindler DA, Laywell ED. Astrocytes as stem cells: Nomenclature, phenotype, and translation. *Glia* 43:62-9, 2003.
64. Mignone, J., Kukekov, V, Chiang, A-S, Steindler, DA, and Enikolopov, G. Neural stem and progenitor cells in nestin-GFP transgenic mice. *Journal of Comparative Neurology* 469:311-324, 2004.
65. Cogle, C., Yachnis, A., Laywell, E.D., Zander, D.S., Wingard, J.R., Steindler, D.A.*, and E.W. Scott. Bone marrow transdifferentiation in the human brain following transplantation, *The Lancet* 363:1432-1437, 2004.
66. Tessitore, A, Martin, M del P., Sano, R, Ma, Y, Mann, L., Ingrassia, A., Laywell, E.D., Steindler, D.A., Hendershot, L.M. and d'Azzo, A. Gm1 ganglioside-mediated activation of the unfolded protein response causes neuronal death in a neurodegenerative gangliosidosis. *Molecular Cell* 15:753-766, 2004.
67. Vig, J., Goldowitz, D., Steindler, D.A., and Eisenman, L.M., Compartmentation of the reeler cerebellum: segregation and overlap of spinocerebellar and secondary vestibulocerebellar fibers and their target cells., *Neuroscience* 130: 735-744, 2005.
68. Zheng, T., Marshall, G., Laywell, E.D., and Steindler, D.A. Neurogenic astrocytes transplanted to the adult mouse lateral ventricle contribute to olfactory neurogenesis, and reveal a novel intrinsic subependymal zone neuron. *Sub for pub.*

69. Laywell, E.D., Kearns, S.M., Zheng, T., Chen, K.A., Deng, J., Chen, H-X, Roper, S.N., and Steindler, D.A., Phenotypic fluidity: neuron-to-astrocyte transition through a hybrid “asteron” phenotype in cultures of differentiating neurospheres, *In press, J. Comp Neurol.*
70. Marshall, GP, Scott, EW, Zheng, T, Laywell, ED, and DA Steindler, Ionizing radiation enhances engraftment of transplanted in vitro derived neural stem cells, *Sub for Pub.*
71. Scheffler, B., Walton, N.M., Lin, DD., Goetz, A.K., Enikolopov, G., Roper, S.N., and Steindler, D.A. Phenotypic and functional characterization of adult brain neurogenesis, *Sub for Pub.*
72. Walton, N., Sutter, B., Chen, H-X., Scheffler, B., Roper, S., and D.A. Steindler. Indefinite culture of human adult glia without immortalization., *Sub for Pub.*
73. Goetz, A.K., Scheffler, B., Chen, H-X, Wang, S, Xiang, H., Brustle, O., Roper, S.N. and DA Steindler, Substrate interactions direct fate choice and specification of neural precursors derived from embryonic stem cells, *In prep.*

OTHER INVITED PAPERS, TRADE PUBLICATIONS, PATENTS, etc.:

Guest editor, Experimental Neurology, “Axonal boundaries and inhibitory mechanisms during neural development and regeneration.” Vol. 109, July, 1990.

O'Brien, T.F., M.A. Gates, C.J. Wilson, and D.A. Steindler, “Glia and Glycoconjugates in the Neostriatum,” in Molecular and Cellular Mechanisms of Neostriatal Function. (M.A. Ariano and D.J. Surmeier, Eds.), 1995, Springer-Verlag, pp. 21-34.

Steindler, D.A. T. Kadrie, H. Fillmore, and L.B. Thomas, The Subependymal Zone of the Adult Brain: “Brain Marrow”, in Progress in Brain Research, 108:349-363, 1996.

Steindler, D.A., Kukekov, V.G., Thomas, L.B., Fillmore, H., Suslov, O., Scheffler, B., O'Brien, T.F., Kusakabe, M., and E.D. Laywell, Boundary molecules during brain development, injury, and persistent neurogenesis - In vivo and in vitro studies, in Progress in Brain Research, 117:177-196, 1998.

Steindler, D.A., Scheffler, B., Zheng, T., Laywell, E.D., Suslov, O.N., and V.G. Kukekov. Neural stem/progenitor cell clones or “neurospheres”: a model for understanding neuromorphogenesis. In, “Neural Stem Cells for Brain Repair”, Humana Press, Zigova, Snyder, and Sanberg, Eds, 2002.

Steindler, D.A. Retrograde axonal transport tracing using wheat germ agglutinin, (3H)-. New Product News, Vol. 1, #5, May, 1982, New England Nuclear Corp.

Laywell, E.D. and D.A. Steindler. Glial stem-like cells: Implications for ontogeny, phylogeny, and CNS regeneration. In Progress in Brain Research 138:435-450, 2002.

Guest Editor, Special Issue on “Glia as Stem Cells in Development and Adulthood”, *GLIA* 43, July, 2003.

Chapter in a book, Parkinson's Disease, Ed. By Ebadi and Pfeiffer, "Translating Stem Cell Biology to Regenerative Medicine for Parkinson's Disease", CRC Press, Jan. 2005.

Patent Issued: "Isolated Mammalian Neural Stem Cells, Methods of Making Such Cells, and Methods of Using Such Cells."

Patent application: "Panels of Microclonal cDNA Pools Arranged According to the Degree of Neural Differentiation".

Patent application: "A Brain Marrow Bioassay".

Patent application: "A New Method for Expansion of Neuronal Progenitor Cells"

Patent application: "A New Method for RNA Expansion From Single Cells"

GenBank 6 ESTs entered from neural stem cells

Co-Founder, NeuroStem, Inc., and RegenMed, Inc.

Co-Founder, The Brain Marrow Project, Methodist Hospitals, Memphis.

OTHER PUBLICATIONS:

63 Abstracts

RESEARCH AND OTHER EXTERNAL SUPPORT:

1973	Special Graduate Traineeship, Wisconsin Alumni Research Foundation.
1974-1975	National Institutes of Health Traineeship, University of Wisconsin.
1976	Awarded Regent's Fellowship, University of California, San Francisco.
1977	Postdoctoral Fellowship, Max-Planck Society.
1978-1982	Biomedical Research Support Grants from Michigan State University.
1989-1992	Principal Investigator, "CNS Pattern Formation Boundaries", NSF.
1981 - present	Co-investigator on several grants, including shared instrumentation grants.
1991	NSF, Research Experience for Undergraduates Grant.

1991- 1995	Hereditary Disease Foundation, “Neuropathology of Huntington’s Disease”.
1980-1995	Principal Investigator “Brainstem Projections to Cerebrum and Cerebellum”, NIH/NINDS.
1993-1995	NSF, SGER grant, “CNS Pattern Formation Boundaries”.
1995-1999	Principal Investigator, “Glia and Glycoconjugates in the Neostriatum”, NIH/NINDS.
1996	Grant from the Japan Society for the Promotion of Science.
1999	"Sleep Regulation and Tumor Necrosis Factor", NIH
1998-2000	Co-Investigator, “Stem Cells in the Spinal Cord”, Spinal Cord Injury Foundation, Paralyzed Veterans of America.
2002	Methodist LeBonheur Healthcare Foundation.
2000-2003	Co-Investigator (Daniel Goldowitz, P.I.), “Histological Phenotyping the Mouse Nervous System”, NIMH.
1999-2003	Principal Investigator, "Studies of Adult Brain Neuropoiesis," NIH/NINDS.
2002-2004	Co-Principal Investigator (with E.D. Laywell, PI), “Astrocytes as Multipotent Stem Cells”, NIH/NINDS
2003	Training grants, University of Florida Program in Stem Cell Biology, Surgery, Allied Health
2003-2008	Principal Investigator, R01, “Studies of Adult Brain Neuropoiesis”, NIH/NINDS.
2003-2007	Principal Investigator, R01, "Altering Fate of Hematopoietic And Neural Stem Cells”, NIH/NHLBI.
2003-2005	Co-Investigator (B. Scheffler, PI), R21, “Stem Cell Integration in the Injured Hippocampus”, NIH/NINDS.
2003	Center for Excellence in Regenerative Health, University of Florida, Governor Jeb Bush and the State of Florida, \$10million funded to date.

STUDENTS AND POSTDOCTORAL FELLOWS:

1982-1983	Lori G. Isaacson, Graduate Student, Michigan State University.
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- 1981-1983 Hisamasa Imai, M.D., Postdoctoral Fellow, Michigan State University. Department of Anatomy; current position - Faculty of Medicine, Department of Neurology, Juntendo University School of Medicine, Tokyo 113, Japan.
- 1987 John B. Schweitzer, M.D., Assoc. Professor, Department of Pathology, University of Tennessee, Memphis , CIDA grant sponsor.
- 1990-1991 Thomas F. O'Brien, M.D. Postdoctoral Fellow, current position Adjunct Assistant Professor, Department of Anatomy and Neurobiology and Center for Neuroscience, Memphis Tennessee.
- 1990 Diane Snow, current position, Assistant Professor, University of Kentucky.
- 1991 Nadia Mitrovic, current position, Postdoctoral Fellow, ETH Zurich.
- 1988-1993 Eric D. Laywell, Graduate Student. Current position, Research Ass't. Professor, Univ. of Tennessee, Memphis.
- 1991-1995 Monte Gates, Graduate Student. Postdoctoral Fellow, with Dr. Anders Bjorklund, University of Lund, Sweden; Research Assoc., Dept. of Neurology, Harvard University; Current - Faculty, Cardiff University.
- 1991 Meyer Horn, NSF sponsored, Research Experience For Undergraduate Awardee. Current, Resident in Medicine, and Dermatology, Northwestern University.
- 1992 Sean Allen, Undergraduate Summer Student, Williams College.
- 1992 Jason Brodkey, M.D., Research Fellow of the Department of Neurosurgery, University Tennessee, Memphis. Current, neurosurgeon, Ann Arbor, MI.
- 1992 Boris Sajin, M.D., Postdoctoral Fellow, Department of Anatomy, University of Zagreb, Croatia; Resident, Dept. of Neurology, Univ. of Iowa.
- 1993-1998 Brannon Thomas, M.D., Research Fellow of the Department of Neurosurgery, Graduate Student, Department of Anatomy and Neurobiology, UT Memphis; current, Ass't Professor, Department of Surgery, East Tennessee State University.
- 1993 Paul Friedman, Medical Student, Summer Research Fellow. Current, Resident, Washington Univ. St. Louis.

1994	David Childress, Medical Student, Summer Research Fellow.
1994	Helen Fillmore, Ph.D., Postdoctoral Fellow. Current, Dept. of Neurosurgery, Medical College of Virginia.
1995	Tarek Kadrie, Medical Student, Summer Research Fellow.
1996 -	Valery Kukekov, Ph.D., Research Consultant, currently, Assoc. Res. Professor, Univ. of Florida.
1997-	Oleg Suslov, Ph.D., Postdoctoral Fellow, currently, Research Associate, Univ. of Florida.
1997-1999	Bjorn Scheffler, M.D., Visiting Scientist from the University of Bonn, currently, visiting Faculty, Univ. of Florida.
2001-present	Tong Zheng, Ph.D., Research Associate.
2002-present	Sean Kearns, Graduate Student.
2002-present	Katrin Gotz, M.D. Postdoctoral Research Fellow.
2003-present	Noah Walton, Graduate Student.
2004	Amy Chen, Graduate Student
1978-present	Member of over 35 thesis committees.

TEACHING EXPERIENCE:

1973-1974	Lectures on electron microscopic technique, Advanced Methods in Physiological Psychology, Department of Psychology, University of Wisconsin, Madison.
1975	Neuroanatomy for Physical Therapy Students, Department of Anatomy, University of Wisconsin, Madison.
1976	Neuroanatomy for Pharmacy; Medical Students, Department of Anatomy, University of California, San Francisco.
1979	Neuroanatomy for Graduate Students (Course Director), Department of Anatomy, Michigan State University.
1979	Neuroanatomy for Medical Students, Department of Anatomy, Michigan State University.

1980-1983	Gross Anatomy for Medical Students, Department of Anatomy, Michigan State University.
1983-1986	Neuroscience for Medical Students, Department of Anatomy and Neurobiology, University of Tennessee, Memphis.
1984-1991	Neurobiology for Physical Therapy Students (Course Director), Department of Anatomy and Neurobiology, University of Tennessee, Memphis.
1985	Neuroanatomy for Dental Students.
1985-1989	Neuroembryology lectures for Neurology Residents, Department of Neurology, University of Tennessee, Memphis.
1986	Lectures in graduate course, "Techniques in Neuroscience", Department of Anatomy and Neurobiology, University of Tennessee, Memphis.
1987-1988	Lectures in neuroembryology, Medical Student embryology course, University of Tennessee, Memphis.
1991-present	Medical Student and Graduate Student Neuroscience, University of Tennessee, Memphis; University of Florida.
2002-present	Lectures on stem cell biology in graduate courses in the Departments of Neuroscience, College of Medicine, Univ. of Florida; Interdisciplinary Graduate Program, Univ. of Florida; School of Journalism, Univ. of Florida.

COMMITTEES AND OFFICES HELD:

Chair, Department of Anatomy Radiation and Biohazard Safety Committee, Michigan State University and University of Tennessee, Memphis, 1979-1985.

Graduate Affairs Committee, Department of Anatomy, Michigan State University, 1981-1982.

All-University Committee on Aging, Michigan State University, 1981-'83.

Chair, Departmental Seminar Committee, Anatomy Department, Michigan State University, 1979-1981.

Chair, Departmental Seminar Committee, Anatomy Department, University of Tennessee, Memphis, 1984.

Medical Student Advisor Program, University of Tennessee, Memphis, 1984-1985.

Departmental Advisory Committee, Department of Anatomy and Neurobiology, University of Tennessee, Memphis, 1984-1986, 1988-1991.

Graduate Affairs Committee, Department of Anatomy and Neurobiology, University of Tennessee, Memphis, 1987-1989.

Medical Scientist Training Program Committee, University of Tennessee, Memphis, 1984-2001.

Director, Memphis Chapter of the Society for Neuroscience, 1987-1988.

Chair, Recruitment Committee, Department of Anatomy and Neurobiology, University of Tennessee, Memphis, 1988-1989.

Promotion and Tenure Committee, Department of Anatomy and Neurobiology, University of Tennessee, Memphis, 1989-2001.

College of Medicine Research Committee, University of Tennessee, Memphis, 1994-2001.

Co-Chair, Univ. of Tennessee, College of Medicine Research Subcommittee on Fund-Raising, 1999.

Univ. of Tennessee, Dean's Departmental Review Committee, 1995.

Chair Search Committee, Univ. of Tennessee Department of Neurosurgery, 1995-1996.

University of Tennessee, Memphis All University Committee on Promotions and Tenure, 1999-2001.

Chair, All University Library Committee, UT Memphis, 1999 - 2001.

Director, Developmental Neurobiology Group, UT Memphis, 1987-2001.

Chairman of Surgery Search Committee, University of Florida, College of Medicine, 2001-2002.

Alzheimer's Chair Search, Department of Neurology, University of Florida College of Medicine, 2003

Search Committee, University of Florida Director of the Office of Media Relations, 2004

NATIONAL COMMITTEES, ORGANIZATIONS, OTHER:

Young Investigator Award Committee, Society for Neuroscience, 1990-1991

Hereditary Disease Foundation, Neurobiology Collaborative Group, 1992-1994.

Consultant, The Brain Marrow Project, Methodist Hospitals Foundation, Memphis.

Grade School Science Fair Judge, Memphis, TN, 1992-2001.

Consultant, External Advisory Committee, NCI, P01, Department of Developmental Neurobiology, St. Jude Children's Research Hospital, 2001-

American Association for Cancer Research, Director of the Cancer Stem Cell Program Reviewing Committee

Fund Raising, University of Florida Foundation and Development Office, lectures throughout the state on issues of “Stem Cell Biology and Regenerative Medicine”

SELECTED INVITED LECTURES:

- 1976 California Institute of Technology, “Neuronal Specificity and the Nervous System of the Reeler Mutant Mouse”
- 1977 National Aeronautics and Space Administration; The Jackson Memorial Laboratory, “Neuronal Specificity and the Nervous System of the Reeler Mutant Mouse”
- 1978 Howard University, Department of Anatomy, “Cerebral-Cerebellar Interrelations”
- 1979 NASA Ames Research Center; University of California, San Francisco, Department of Anatomy, “Axonal Transport of Various Tracers Including Wheat Germ Agglutinin”
- 1980 McGill University, Department of Physiology; University of Pennsylvania, Department of Anatomy; University of Pittsburgh, Department of Physiology; Medical College of Wisconsin, Department of Anatomy, “Collateral Branching of Substantia Nigra Neurons”
- 1981 Vanderbilt University, Department of Psychology, “Organization of Divergent Axonal Projections from the Substantia Nigra and Locus Coeruleus”
- 1982 Parkinson’s Disease Foundation, “Patterns of Divergence in Brainstem Axonal Projections”.
- 1983 Northeastern Ohio University Colleges of Medicine, Department of Anatomy; Vanderbilt University, Department of Anatomy, "Development of Patterns of Divergence in Brainstem Axonal Projections”
- 1984 University of California, San Francisco, Department of Physiology; Vanderbilt University, Neurobiology Seminar Series, “Developmental and Regional Aspects of Lectin- and Toxin-Binding in the Nervous System”
- 1985 University of Wisconsin, Madison, Department of Anatomy; Medical College of Wisconsin, Cell and Molecular Biology Seminar Series, “Developmental and Regional Aspects of Lectin- and Toxin-Binding in the Nervous System”

- 1986 Medical College of Wisconsin, "Pattern Formation in the Central Nervous System"
- 1988 Yale University, Department of Human Genetics, and Section of Neuroanatomy; Rutgers University, Center for Molecular and Behavioral Neuroscience, "Boundaries Defined by Glia and Cell/Substrate Adhesion Molecules During Brain Development In vivo and In vitro"
- 1989 Massachusetts Institute of Technology, Department of Brain and Cognitive Science; Tufts University, Center for Neuroscience; E.K. Shriver Center; Case Western Reserve University, Center for Neuroscience; Bowman Gray School of Medicine, Department of Anatomy; Medical College of Pennsylvania, Department of Anatomy, "Brain 'Cordones': Glial and Glycoconjugate Boundaries that Define Developing Functional Units"
- 1989 Invited organizer, Special Topics Session, American Association of Anatomists, New Orleans, "Adhesion Molecules, Transient Boundaries, and Nervous System Pattern Formation"
- 1989 University of Heidelberg, Department of Neurobiology; Swiss Federal Institute of Technology, "Brain 'Cordones': Transient Boundaries of Glia and Adhesion Molecules that Define Developing Functional Units"
- 1989 Invited speaker in a Satellite Symposium on Cerebral Cortical "Barrels", Neuroscience Meeting, Phoenix, Arizona
- 1990 Invited speaker, symposium on Glial-Neuronal Interactions, Cambridge, England, sponsored by the New York Academy of Sciences and Cambridge University
- 1990 Oxford University, Department of Anatomy; College de France, Paris, Molecular Biology Group; University of Heidelberg, Department of Neurobiology; University of Arizona, Division of Neurobiology, "Boundaries and Wounds, Glia and Glycoconjugates"
- 1990 Invited guest, Social on "Are Your Growth Cones Inhibited? Will Wine and Cheese Help?" Society for Neuroscience Meeting, St. Louis
- 1991 Washington University, St. Louis, and St. Louis University, "The Functional Organization of the Glial Scar"

- 1991 Invited organizer, Social on “Developmental Neurobiology: Intrinsic and Extrinsic Determinants of Cerebral Cortex”, Society for Neuroscience Meeting, New Orleans
- 1991 Carnegie Mellon University, Department of Biological Sciences, “Boundaries During Neural Pattern Formation and Injury”
- 1992 Invited speaker, symposium on “Development, Growth, and Senescence in the Chemical Senses”, National Institutes of Health, National Institute on Deafness and Other Communicative Disorders
- 1992 Invited speaker, workshop on neural pattern formation, Winter Conference on Brain Research, Steamboat Springs, CO.
- 1992 Invited speaker, Cajal Club, Forum on Developmental Biology, New York, New York, “Common Programs for Glia During Brain Pattern Formation and Injury”
- 1992 Southeast Neuroscience Symposium, invited speaker, Birmingham, Alabama
- 1992 Invited speaker, Symposium in honor of the 10 year anniversary of the Queen Sophia Award, Madrid, Spain
- 1992 Invited lecturer, Instituto Cajal, Madrid, Spain, “Astrocytes and Extracellular Matrix Molecules that Form Boundaries During Brain Development and Injury”
- 1992 Invited speaker, Department of Anatomy, Georgetown University, “Astrocytes and Extracellular Matrix Molecules that Form Boundaries During Brain Development and Injury”
- 1993 Invited speaker, Department of Cell Biology and Neuroanatomy, University of Minnesota, “A Role for Tenascin in Brain Wound Healing”
- 1994 Department of Cell Biology, Duke University Medical School, “Brain Boundaries and Scars: Programs for Normal Development and Wound Healing”. Grand Rounds, Departments of Neurosurgery and Neurology, UT, Memphis, “Traumatic Injury and Neurodegenerative Disease: Cell-Molecular Changes and Interventions”
- 1995 St. Jude Children's Research Hospital, Department of Neuro-Oncology, “Astrocytes and Extracellular Matrix in Brain Development, Injury, and Neoplasia”
- 1995 University College, Cork, Ireland, Invited Speaker, Symposium on glial barriers

- 1995 Invited speaker, Distinguished Lecture Series, University of Arkansas Medical School and Center for Neuroscience, Little Rock, Arkansas, "Cell and Molecular Interactions Prevalent During Brain Development, Injury, and Neoplasia"
- 1996 JSPS Fellowship to Visit the Laboratory of Cell Biology, RIKEN, Ibaraki, Japan. Seminars, Human Frontiers Group, RIKEN, Waco, Japan, and the University of Osaka, "Cell and Molecular Analysis of Brain Boundary Molecules In Vivo and In Vitro"
- 1996 Invited speaker, Department of Anatomy and Cell Biology, University of Michigan, "Astroglial Boundary Molecules In Vivo and In Vitro"
- 1997 Invited plenary speaker, Brain Research Association of Great Britain, Liverpool, "Brain Boundary Molecules and Cells, In Vivo and In Vitro." (British Broadcasting Company, "Science Today" interview)
- 1997 Invited speaker, Spring Meeting in Berlin, "Regulatory Mechanisms in Neural Plasticity", Georg-August University, Gottingen
- 1997 Invited speaker, Netherlands Institute for Brain Research International Neuroscience Summer School
- 1997 Invited speaker, George Washington University Medical Center, Department of Anatomy and Neurobiology, "Extracellular Matrix Molecules During Brain Development, Injury, and Persistent Neurogenesis"
- 1998 Brain Awareness Week Lecturer, Christian Brothers University, Memphis, Tennessee, "Brain Marrow"
- 1998 University of Rochester, Department of Neurology, "Extracellular Matrix Molecules During Brain Development, Injury and Persistent Neurogenesis"
- 1998 Susan B. Hellams Lecturer, The Medical College of Virginia, Richmond, "Extracellular Matrix Molecules During Brain Development, Injury and Persistent Neurogenesis"
- 1998 Promega Corporation, "Cell and Molecular Characterization of Brain Marrow"
- 1998 Children's Memorial Institute for Education and Research, Neurobiology Program, Northwestern University, "Cell and Molecular Characterization of Mouse and Human Brain Marrow"

- 1999 Emory University, Department of Physiology, "Cell and Molecular Characterization of Brain Marrow"
- 1999 CLONTECH Laboratories, Palo Alto, CA, "The Cell and Molecular Biology of Adult Neural Stem Cells"
- 1999 The Chicago Medical School, "Molecular and Cellular Characterization of Adult Brain Neuropoiesis"
- 1999 The Cold Spring Harbor Laboratory, "Molecular and Cellular Characterization of Adult Brain Neuropoiesis"
- 1999 Meeting on Ataxia Telangectasia, The Banbury Center, "Stem Cells in the Adult Human Brain"
- 1999 University of Wisconsin, Madison, Waisman Center, "Molecular and Cellular Characterization of Adult Brain Neuropoiesis"
- 2000 The University of South Florida, "Stem Cells in the Adult Human Brain: Molecular Cell Biology and Clinical Applications"
- 2000 The University of Florida, Gainesville, "Stem Cells in the Adult Human Brain: Molecular Cell Biology and Clinical Applications"
- 2000 Chicago Chapter Society for Neuroscience Symposium Speaker, "Stem Cells in the Adult Human Brain: Molecular Cell Biology and Clinical Applications"
- 2000 FEBS and EC course invited presenter, "Techniques for Gene Manipulation Targeting and Delivery in the Nervous System", Bristol, England
- 2000 International Society for Experimental Hematology, invited plenary speaker, "Brain Marrow Neuropoiesis: Cell, Molecular and Transplant Studies of Adult Brain Neurogenesis"
- 2000 The University of New Mexico, "Stem Cells in the Adult Human Brain: Targets for Gene Discovery, Transplantation, and Transformation"
- 2000 Distinguished Lecture Series, UMDNJ Robert Wood Johnson Medical School, "Stem Cells in the Adult Human Brain: Targets for Gene Discovery, Transplantation, and Transformation"
- 2000 St. Jude Children's Research Hospital, "Stem Cells in the Adult Human Brain: Targets for Gene Discovery, Transplantation, and Transformation"
- 2000 Titan Pharmaceuticals, Somerville, New Jersey, "Stem Cells in the Adult Human Brain: Targets for Gene Discovery, Transplantation, and Transformation"
- 2001 The American Association for Cancer Research, New Orleans, LA., invited plenary symposium speaker, Stem Cells, "Neural Stem Cells".

- 2001 The Society of Biological Psychiatry, New Orleans, invited symposium speaker, "Neuron Life and Death: Promises and Pitfalls ".
- 2001 The Netherlands Institute for Brain Research, International Summer School, "Plasticity in the Adult Brain: From Genes to Neurotherapy", invited symposium speaker on adult neural stem cells.
- 2001 Stem Cell Symposium, Brain Research Interactive, Satellite to the Society for Neuroscience Meeting, San Diego, CA., "Multipotent Astrocytic Stem Cells in Normal, Postmortem, and Tumorigenic Brains"
- 2001 George Washington University, Washington D.C., "Stem Cells and Neurogenesis in the Adult Human Brain".
- 2001 Harvard University, Massachusetts General Hospital, "Stem Cells in the Adult Human Brain"
- 2001 Invited symposium speaker, American Society for Hematology, "Stem Cells and Neurogenesis"
- 2001 *Discovery Channel* documentary, "The Science of Death"
- 2002 AstraZeneca Scientific Advisory Board speaker, San Juan, Puerto Rico.
- 2002 National Institutes of Neurological Diseases and Stroke, Invited workshop participant on stem cell banking
- 2002 Invited speaker, symposium, glial stem cells
- 2002 Invited speaker on stem cell and cloning policy, Chancellor and the Ministry of Science, Vienna, Austria
- 2002 Grand Rounds, Neurology, University of Tennessee, Memphis, "Translating Stem Cell Biology to Regenerative Medicine"
- 2002 University of Texas, San Antonio, Cajal Center Speaker, "Translating Stem Cell Biology to Regenerative Medicine"
- 2003 Keynote Speaker, International Neuropsychological Society, Hawaii
- 2003 Invited Speaker, Cajal Club Debate on Stem Cells, Society for Neuroscience Meeting, New Orleans
- 2003 Speaker, Parkinson's Day and Support Groups, Univ. Florida
- 2003 Invited Speaker, Ocala Grand Dames for Cancer Research
- 2003 Invited Speaker, Hospital for Special Surgery Symposium, New York, "Place of Adult Stem Cells in Orthopaedics"
- 2003 Ocala Shakers, South Marion County Parkinson's Support Group, "Translating Stem Cell Biology to New Therapeutics for Parkinson's Disease"

- 2004 University of Miami, “Translating Stem Cell Biology and Regenerative Medicine to New Therapeutics for Parkinson’s Disease
- 2004 Keynote Speaker, Society for Neuroscience Chapter, Chicago
- 2004 Invited Speaker, UCLA Brain Repair Series
- 2004 International Stem Cell Symposium, Genoa, Italy
- 2005 Neurology Grand Rounds, University of Florida
- 2005 Chicago Brain Repair Club, Keynote Speaker
- 2005 Co-Chair, US Army Exposure Treatment Research Program, Parkinson’s Treatments, Tampa, Florida
- 2005 Keynote speaker, Annual Shepherd Center Brain Injury Conference, “Stem Cells and Regenerative Medicine for TBI”
- 2005 “An Evolutionary Approach from Extracellular Matrix to Stem Cells”, University of Massachusetts Medical School

RESEARCH INTERESTS:

Developmental neurobiology, traumatic brain injury and neurodegenerative diseases including Parkinson’s Disease, CNS regeneration, stem cells and persistent neurogenesis in the adult human brain, and brain tumorigenesis.

The major research goal of my program is to see the use of stem cell therapy become a major treatment for debilitating neurological diseases. There is widespread interest in the use of stem cells for cell replacement therapies in human neurological disease; however, we have only begun to appreciate the cell and molecular biology of these cells which hold great promise for transplantation or other therapeutics relying on the potential use of our own persistent stem/progenitor cell population in autologous repair paradigms. Five different but concurrently run sets of experiments aim to advance our understanding and use of neural stem cell therapies. The five approaches are: 1) The development and refinement of new *in vitro* methodologies that, in part, rely on insights from studies of hematopoiesis to selectively expand particular stem or progenitor cell populations and also control their differentiation into particular types of neurons; 2) The discovery of genes involved in stem cell growth and differentiation using clonal populations of stem/progenitor cells as a model for neurogenesis, by way of creating cDNA libraries from normal and neurological disease brain; 3) Use of animal models and *in vitro* bridge bioassays of neurodegenerative disease, particularly Parkinson’s Disease, by a dedicated cell culture and transplant group in the lab that is refining methods of integrating grafted stem/progenitor cells into altered adult brain circuitries; 4) Stem cell plasticity and homing in a variety of tissues; and 5) Studying distinct stem/progenitor cell populations as a potential source of primary tumors.

In addition to augmenting the *ex vivo* expansion, and attempting to control fate and differentiation of stem/progenitor cells isolated from the postnatal and adult periventricular subependymal zone using culture methods developed in our lab that affect cell-cell and cell-

substrate interactions, we also are using new molecular approaches (e.g. cDNA libraries from single stem/progenitor cell clones) to characterize novel developmental genes involved in cell genesis, survival and cell death. The main strategy of these studies is to exploit well-known approaches for gaining access to signaling pathways that direct cell survival, proliferation, and fate determination. As these gene expression profiles are refined, future approaches can rely on stem/progenitor cells as vehicles for gene therapy in human disease. It is even possible that gene-discovery studies will lead to the development of new drugs that expand our resident, quiescent stem/progenitor cell populations within marrow and other CNS sites, and lead to their migration and differentiation within cell-deficient targets without the need for *ex vivo* manipulation and grafting. Finally, a part of our team has begun to exploit similar cell and molecular approaches to study cellular morphotypes and genes involved in stem/progenitor cell growth associated with pediatric and adult brain tumors. Again, gene discovery and subtractive methods are used to compare normal and abnormal gene expression associated with normal neurogenesis versus that seen in neurodegenerative disease and brain neoplasia.

The studies listed above compare cell and molecular characteristics of normal and transformed cells to define basic principles of normal and abnormal stem cell growth and differentiation. We rely on the use of transgenic mouse models of disease to isolate and characterize engineered or primed stem/progenitor cell populations, and then reintroduce and study these cells in altered tissues and compromised CNS circuitry arrangements that represent particular hallmarks of degenerative and oncogenic disease. This is in keeping with the convergence of transplantation and tumorigenesis studies in the bone marrow hematopoiesis field. The study of adult human brain neurogenesis likewise requires rigorous experimental investigation of the biology of neural stem cells, as has been applied to their counterparts in blood.

Most recent stem cell studies in the lab focus on near-future applications of neuroprotection and neurorepair in Parkinson's as well as other neurological conditions.